SCOET

Standing Committee on Educational Technology

Electronic Communication Systems

❖ B.C. Colleges & Institutes

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Electronic Communication Systems

An Assessment of the Current Status at B.C. Colleges & Institutes

November 1991

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Preface

The Standing Committee on Educational Technology

Purpose

The Standing Committee on Educational Technology (***SCOET***) is a committee representing the college and institute system with a mandate to monitor and assess changes in educational technology, and to propose policy directions for the system as a whole. The committee was established in June 1990 under the direction of the Council of Chief Executive Officers (**CCEO**), and is funded by the Ministry of Advanced Education, Training and Technology.

Objectives

SCOET's intention is to foster an internationally competitive education system for British Columbians in light of the rapidly expanding role of educational technology within education systems worldwide.

The committee is collecting information about all relevant aspects of educational technology both from sources within our system and from national and international sources. This information is being used to develop strategic direction recommendations to the Council of Chief Executive Officers (**CCEO**) of the Advanced Education Council of British Columbia.

Reports

This document is one in a series of reports that the committee will be completing and distributing within the college and institute system. It is the product of one of a series of surveys that the committee is undertaking in order to assess the current status of a specific area of educational technology in our system.

The surveying process, while time consuming and work intensive, is considered the most effective way for the committee to acquire accurate and reliable information from which to base its recommendations. The committee owes great thanks to everyone assisting with the ongoing collection of this information.

Acknowledgments

The Chairman acknowledges and extends his appreciation to our Communications Subcommittee, Jim Bizzocchi and Randy Bruce, and SCOET research and technical assistant, Michael Quinlan, for their work in producing this report.

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Executive Summary

SCOET initiated the Electronic Communications Project because the communications technologies which currently interconnect the colleges and institutes do not satisfy the needs of the system in an effective, flexible manner. Most of the hardware and software being used is outdated and is not equipped to take advantage of the significant changes which are occurring in the arena of communications in B.C. The report is an inventory of the technologies which affect the college and institute system's ability to communicate electronically.

The committee utilized two surveys to explore many of the elements related to communications technologies as the basis for this report. The entire system was surveyed for information about primary computing platforms, external communications links, access to and use of electronic mail and the presence or absence of computer conferencing facilities. Access to basic information systems such as student records, library cataloguing, and budgeting systems was also surveyed. This information provides a thorough assessment of each institution's ability to communicate effectively both within its own boundaries as well as with other institutions.

Just over one third of the college and institute system does not have access to electronic mail or file transfer to other campuses and regional centres or to outside institutions. This is primarily a function of the perception that costs associated with making such a connection are prohibitive. It is also related to the lack of knowledge of how increasing the scope of telecommunications connections can enhance the productivity and value of other research and education initiatives.

Presently at B.C. colleges and institutes there are three models of connectivity. Some of the colleges do not have the resources to deliver electronic mail between individuals on the same campus. Other institutions can send and receive internal mail and external mail via an inefficient and expensive network which connects most of the system. Meanwhile, a handful of colleges are connected to networks which allow their educators and students to exchange electronic messages with colleagues around the world at no additional cost.

Of the colleges and institutes which provide access to electronic mail and file transfer outside the boundaries of their own campuses (the second group mentioned above), more than half are restricted to doing so using technology that is expensive and outdated. These institutions are being charged for the total amount of data transmitted every time something is sent. This has meant that administrators have had to carefully restrict and monitor access to telecommunications resources. It has made budgeting for communications very difficult, and has resulted in restricted access to global electronic mail systems for our students. One of SCOET's goals is to help reconcile the above inconsistencies and attempt to improve telecommunications for the entire system.

Very few of the colleges are using any form of computer mediated communications (conferencing), and most are using electronic mail software (EAN) which has not been significantly updated since 1985 when it was first developed and released. Conversely, most of the

colleges support access to on-line information systems. The most common and widely used application of information systems is electronic library cataloguing, followed by student records and registration systems. The use of information systems drops off dramatically from there.

The communications infrastructure in B.C. is changing rapidly. Post-secondary institutions, research centres and businesses are all moving towards computing resources which focus on telecommunications flexibility. Within the educational system there are a variety of initiatives that involve the significant use of province-wide electronic communications, yet there is no overall coordination of these initiatives. (See *Other Initiatives*, p. 19-21, and *Telecommunications Infrastructure*, p. 49-53)

Our intention with this report is to describe the state of computer based communications in the college and institute system. We had not intended to make any recommendations in this document. However, our surveys and discussions have led us to the conclusion that there is one recommendation compelling enough to be made without further review and urgent enough to be made (and acted on) immediately.

The uncoordinated and haphazard proliferation of overlapping agendas and plans in the area of educational electronic communications is counter-productive. It will lead to unnecessary duplication of effort in some cases, while in others it will result in real needs being overlooked. The college and institute system is especially vulnerable in this situation. The K-12 system has its vehicle for leadership and coordination in this area - the Educational Technology Centre. The universities are large enough to create their own priorities and opportunities. The colleges and institutes have neither of these advantages.

The next step for the SCOET electronic communications systems sub-committee will be to take the information in this report and work with the system to address development issues and come up with further recommendations for improvements.

❖ ❖ ❖ Recommendation

The provincial government should take immediate steps to assist in the rationalization of the disparate efforts in the area of educational electronic communications and facilitate an overall coordinated planning process. This process of rationalization should be monitored by the Ministry of Advanced Education, Training and Technology and by the Council of Chief Executive Officers. These two bodies should ensure that the issues facing the colleges and institutes are being addressed and that their needs are being met.

(An appropriate first step would be a meeting, or a series of meetings, involving the key institutions and groups in the area of computer communications in British Columbia.)

VISION: Towards an Electronic Community of Educators

Our goal for computer communications is to help build an electronic community of educators in our province. We see a future where the educators of British Columbia become one functional community, freely exchanging information and views, building connections and working in teams on a wide variety of projects.

Some of the components that would help accomplish this goal are:

- more networked computers in the system, for internal and external communications;
- simple, accessible, user friendly interfaces and communications processes;
- access to internal information systems as appropriate to an individual's needs and position (e.g. library catalogues, student records, room booking...etc.);
- access to communication services such as:
  - internal and external electronic mail and file transfer;
  - local, regional and international distributed computer conferencing;
  - external content databases for discipline-specific information.

The implications of these measures are profound and far-reaching. Our system will have a functional unity from kindergarten to graduate level based on wide ranging formal and informal communication patterns. Projects, both scholarly and commercial, will be developed by colleagues at various institutions as appropriate. Working partnerships will evolve between educators and other experts in different locations with complementary skills and real needs. Our students will develop the skills needed to obtain information and expertise from sources all over the world.

Our objectives are threefold:

1) To maximize communication within the educational sector in British Columbia.
2) To increase collaboration between the educational sector and the private sector within our province.
3) To provide our educators and learners access to the global world of electronic communications.

A complete review of the applications and services available through networking is beyond the scope of this report. These applications and services are significant and are growing exponentially worldwide.

Some specific examples include:

- local and international electronic mail and file transferring;
- worldwide electronic conferencing;
- access to information, research, and library databases all over the world;
- interconnection to remote computer applications;
- access to other related communications applications such as audio conferencing, audio graphics and compressed video.

Improving data connections both within and between the colleges and institutes will significantly enhance the productivity and value of all research and educational resources. The implications of an electronic community of educators and learners are very significant for our educational system. Distance will be reduced as a barrier to collaborative work. Time constraints will be ameliorated because computer communications do not require simultaneous contact. The pools of information and talent at our educational institutions will be both strengthened and made accessible through simplified and universal communications methods.

The colleges and institutes must be able to provide students with access to the electronic world. Many students are already exposed to the potentials of the information age by the time they complete secondary school. At the colleges and institutes they must be able to learn current and advanced techniques of networked communications and database navigation in order to lead successful and productive working lives. Significantly expanding the communications resources at the colleges and institutes is the best way to bring our students into the information mainstream.

The changing labour markets indicate the need for a supply of highly skilled individuals who are prepared to meet the demands of the modern workplace.[1] The enhancement of electronic communication systems at the colleges and institutes is an essential first step in meeting those demands.

[1] British Columbia. Ministry of Advanced Education, Training and Technology. *Forces of Change Influencing Education and Training* (Victoria, 1990), p. 26.

Project Methodology

This project began in February 1991 with a telephone survey which gathered information about which types of communications hardware and software the colleges and institutes had and were using. Six key areas relating to electronic communications were explored to determine the status of electronic communications at the colleges and institutes.

During the summer a second survey was completed to gather further electronic communications details about each institution, as well as details on access to information systems. The committee received 100% return on the second survey and was able to produce the network maps in Appendix C from the information provided.

This report is divided into three main sections:

- The first section is the body of the report. It includes the results of the information gathering phase of this project, the committee's vision of communications in the future and some current communications issues.
- The second section provides the communications background to the college and institute system. It details how the system is currently configured, what networks are currently operational and available to post-secondary institutions and briefly describes some communications related initiatives.
- The third section contains the terms of reference for this project, network diagrams for the colleges and institutes, an overview of the telecommunications infrastructure in B.C., the data gathered by both surveys and an extensive glossary of terms.

Trends & Issues

During the surveying process for this project, the committee identified the following trends which significantly impact on communications:

Trend **A.** *There are a number of initiatives within the education system that involve significant use of electronic communications.*

Issue Without the overall coordination of these individual efforts, time and money will be wasted.

Trend **B.** *Data traffic is increasing everywhere. For example: the international conglomeration of regional and national networks that BCnet connects to (the Internet) is currently increasing at a rate of at least 10% per month*[2].

Issue The need to accommodate data traffic growth is increasing in B.C. at all levels. The current communications structure that the colleges and institutes have access to does not meet current high speed data transmission needs let alone allow for potential growth.

---

[2] Al Gore, "Infrastructure for the Global Village", *Scientific American*, September, 1991, p. 153.

Trend **C.** *Communications links have become faster, cheaper, more reliable and easier to share.*

Issue Sharing the high speed communications lines can decrease individual institutional costs. For example, most B.C. colleges and institutes cannot make the connection to BCnet because of the cost of the data lines. Encouraging other institutions and organizations to connect, such as primary and secondary schools, hospitals and public libraries, both decreases the individual costs of maintaining the line(s) and increases the penetration (thus the value) of the network.

Trend **D.** *The ease of multi-vendor connectivity is a driving force in the adoption of the Unix operating system. This is made possible by the inclusion of industry-standard networking software (TCP/IP).*

Issue Most of the colleges and institutes are not poised to take advantage of these developments because the DEC VAX/VMS systems they use are not equipped to support the TCP/IP networking standard.

Trend **E.** *Electronic messaging systems have the potential to significantly improve communications between B.C. educators, students and industry.*

Issue The educational system needs a strategy to take advantage of this potential. Currently it is not possible to communicate electronically between all colleges and institutes - this hampers effective collaboration.

Summary and Assessment of Responses

This section summarizes some of the results of the telephone survey conducted by the Standing Committee on Educational Technology in the Spring of 1991. It provides a brief but detailed look at the current status of operating systems, external network links, and access to internal information systems within the college and institute system. It includes information from the B.C. college and institute system as classified by the Ministry of Advanced Education, Training and Technology in the list below:

Urban Colleges: Camosun College, Capilano College, Douglas College, Kwantlen College, Vancouver Community College.

Small Colleges: East Kootenay Community College, College of New Caledonia, Justice Institute, North Island College, Northern Lights College, Northwest Community College, Pacific Marine Training Institute, Selkirk College.

University Colleges: Cariboo College, Fraser Valley College, Malaspina College, Okanagan College.

Institutes: British Columbia Institute of Technology, Emily Carr College of Art and Design, Open Learning Agency.

1. Main Computing Platforms

This section of the survey looked at information about the main computing platform(s) at each institution, including:

- specific operating systems being widely used;
- descriptions of links to satellite campuses and other institutions and/or networks;
- who at each institution has access to information systems applications.

Summary:

- 17 out of 20 institutions are using the VMS operating system running on DEC VAX computers.
- 8 out of 20 institutions have purchased machines running the Unix operating system. Many institutions expressed a desire to expand their Unix based computing resources because it has become the *de facto* standard for cost effective open computer systems.
- Other operating systems supported at one or two institutions are VM (an IBM mainframe operating system), HP3000 (for Hewlett Packard computers), PRIMOS (for PRIME computers), MacOS (for the Macintosh environment), and a Data General operating system.

The following charts detail the occurrence within the system of each of nine computer operating systems as main computing platforms.

Figure 1 - **Main Computing Platform(s)**

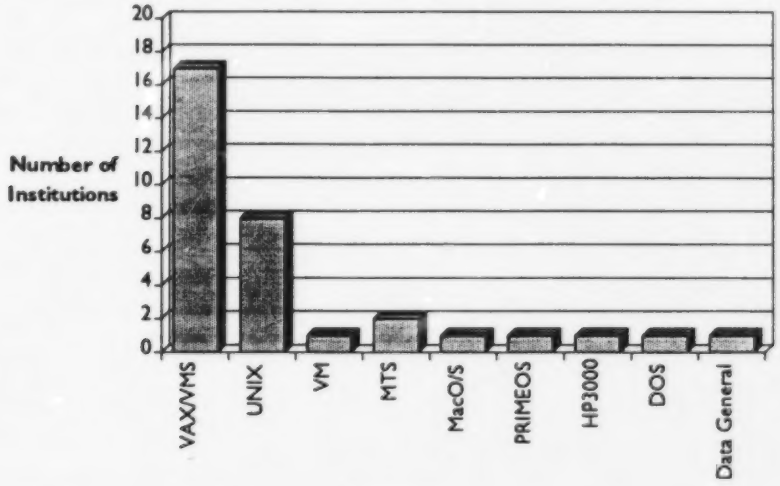
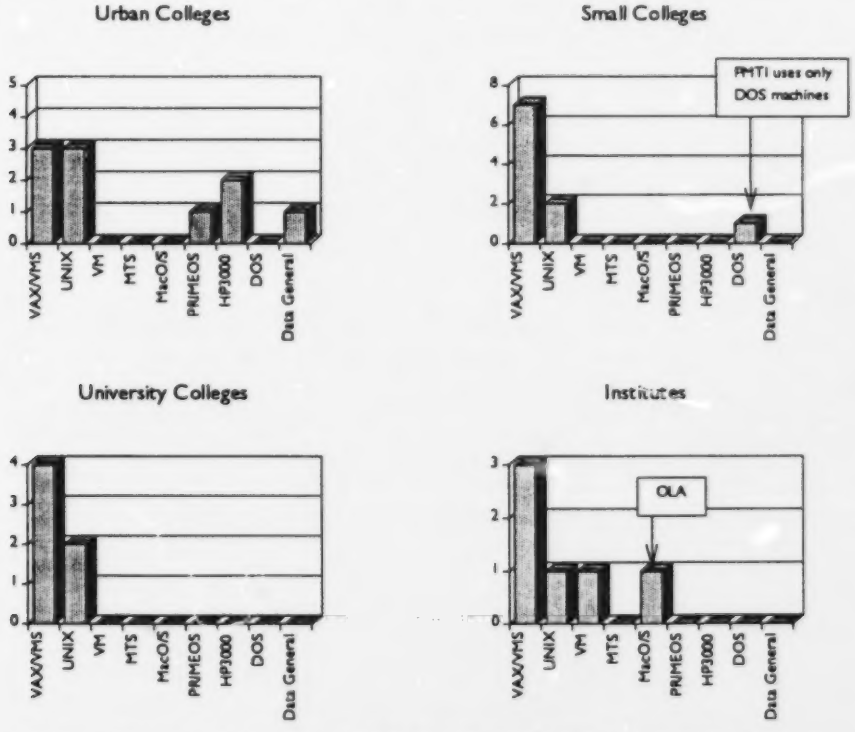


Figure 2 - **Computing Platforms by Ministry Classification**



[**Note:** The universities are well equipped with each of UNIX, VMS and either VM or MTS (for the IBM computing environment) and are not included in the above charts.]

2. Wide & Local Area Networks

This part of the survey looked briefly at the existence of wide and local area networks, PC or terminal labs at each institution.

Summary:

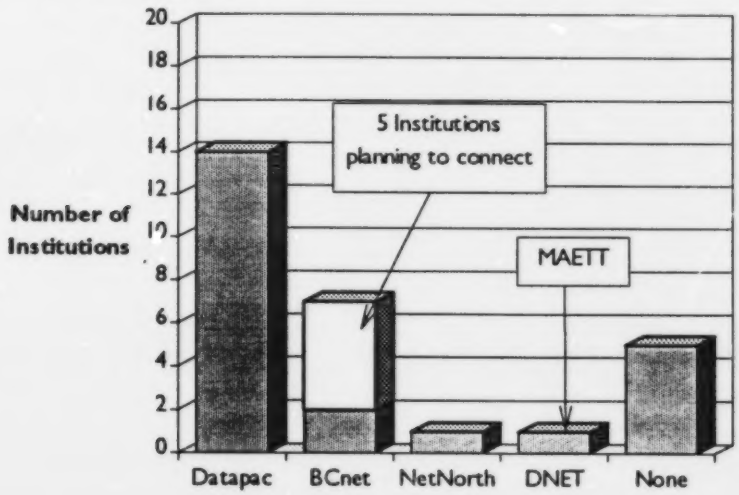
- Only one institution does not have some sort of local area network (LAN) set up. All other institutions have one or more LANs each of which are either stand-alone, connected to a file or print server, or connected to a larger network.
- 14 out of 20 institutions have what may be considered wide area network configurations.

3. External Network Links

This area of the survey explored existing dedicated links from each of the colleges and institutes main campus centres to external communications networks.

The following chart summarizes the college and institute system's connections to external networks:

Figure 3 - **External Network Connections**

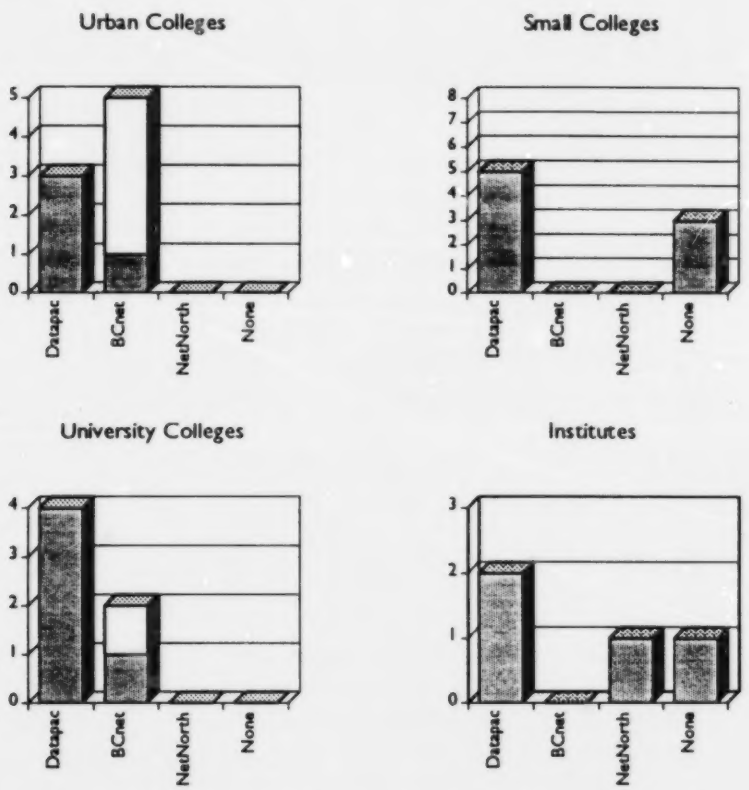


Summary:

- 14 out of 20 colleges and institutes are connected to Datapac (X.25 network).
- Two colleges are presently connected to BCnet with five additional colleges making the connection in the next six months.
- BCIT is the only institution directly linked to NetNorth.
- Five institutions are not connected to any form of external network.

- The Ministry of Advanced Education, Training and Technology is the only organization directly connected to DNET.

Figure 4 - **External Network Connections by Institutional Classification**



For a graphical representation of external network connections by institution please see Appendix C - Institution Network Diagrams.

4. Electronic Mail

This section gathered information about what types of electronic mail protocols institutions are using. Electronic mail transmission depends largely on the primary operating system and the network configuration of the institution (Sections 1 & 3).

Summary:

- Each of the 17 institutions using the VMS operating system have access to VMS mail at the internal level.
- 14 of these 17 are connected to the X.25 network (Datapac) using resources provided by DEC.
- Five of these 14 colleges either prevent or control student access to external mail. Only Okanagan

College offers unlimited access to external mail despite the associated Datapac charges.

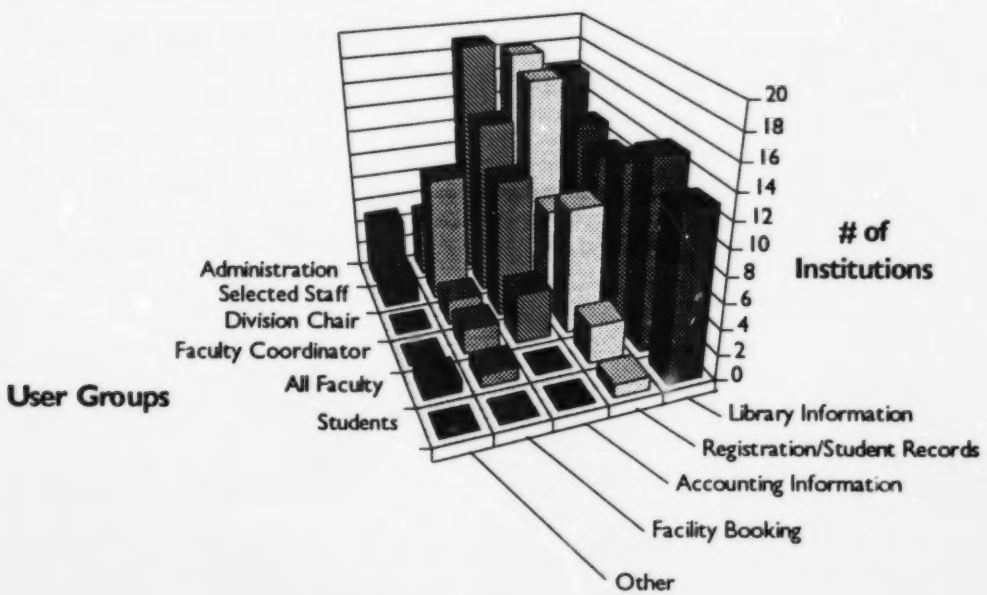
- Each of these 14 have the capability to use external VMS mail.
- 12 of these 14 are using the distributed mail handling system called EAN. This system was developed in 1985 at UBC for the Unix and VMS environments.

5. Access to Information Systems

This information was compiled later in the summer of 1991. It summarizes which internal information systems are being used at each institution and by whom.

The following graph displays the internal information systems that each of the listed user groups can access. User groups are located along the left axis and applications are distinguished by the shaded rows from left to right. The number of colleges and institutes are displayed along the vertical axis:

Figure 5 - **Distribution of information systems access throughout the system**



Summary:

- Most institutions provide access to library information systems to everyone that needs it.
- Access to Registration / Student Records systems and financial systems are widely used by higher administrative and faculty levels.

Under the category of "Other" applications fall various uses of information systems such as room booking, work order control, bookstore booklist, inventory and staff attendance. Because these applications are usually the result of individual institutional initiatives they are not widely dispersed throughout the system.

6. BBS/Conferencing

This section gathered information about the existence and use of computer bulletin boards and conferencing systems at the colleges and institutes.

Summary:

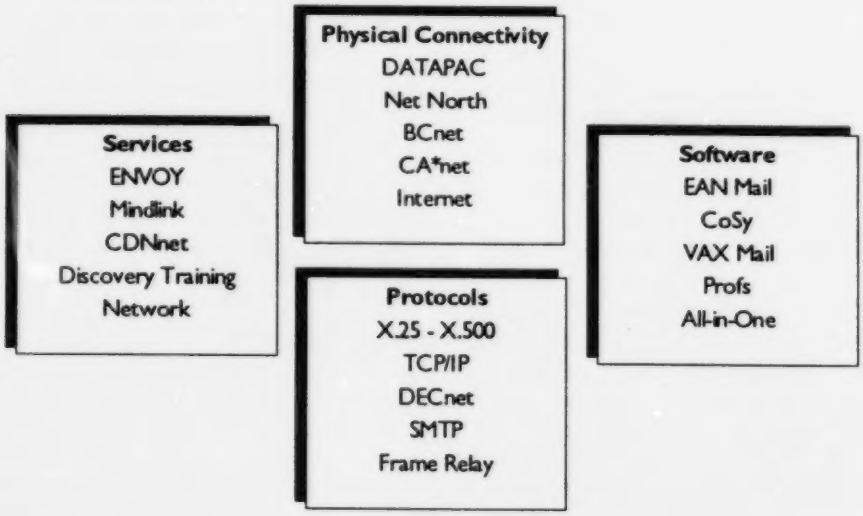
Very few colleges and institutes are using any form of conferencing systems or bulletin board systems.

- Four colleges are using VMS CoSy which was purchased for the college and institute system in 1987. Most of the other institutions who received CoSy removed it because of technical problems.
- Two institutions are using VMS news reading software to accept news-feeds from external sources. Other institutions use e-mail systems to access distributed news.

Protocols & Terms

It is difficult to grasp the significance of much of the information contained in this report without having some idea of the role of communications protocols. These protocols are like languages that individual computers speak. Some computers, like some people, speak many languages and are therefore adaptable to advanced communication technologies (e.g. TCP/IP). Other computers speak only one language, their own, and are therefore less adaptable and may require the electronic equivalent of an interpreter in order to communicate with other computers (e.g. X.25).

The following graphics places some common telecommunications terms and services into independent categories from which they can best be understood:



The College & Institute System

The colleges and institutes in B.C. began purchasing DEC VAX computers over a decade ago. The purchase of a provincial license for the Budgetary Accounting System (BAS), accounting software which runs on VAX machines, was a factor in the initial popularity. Soon thereafter Camosun College developed and released their student records software (SRS) and the tendency to go with VAX machines was well in place. Market conditions, pricing and support from the Ministry led to many requests for VAX machines from the colleges.

In 1982-83 DEC gave every institution with a VAX computer the hardware and the software required to connect to Datapac, Telecom Canada's X.25 packet switching network. This enabled institutions to transfer files, send and receive electronic mail, and initiate remote terminal sessions. The Datapac network, which extends internationally to over 100 countries, uses a "volume sensitive" charging system where users pay for every packet of data transmitted on top of connection charges for some calls.

The software required for this (DECnet) is proprietary, that is, it only works with data from other DEC machines. This has been a problem for institutions which have purchased other types of computing systems. Capilano College, BCIT, Douglas College and Vancouver Community College have computing systems other that DEC VAXs. Three of these institutions (VCC, Douglas and Capilano) have been virtually excluded from computer communications with the rest of the system. BCIT has access to external electronic mail delivery via NetNorth.

Electronic mail became common between connected institutions after the development the EAN distributed message handling system in 1985. This system supported a "store and forward" type of message handling, which means that messages can be composed at any time and the system takes care of sending the messages by connecting and transmitting at regular intervals. Although EAN does adhere to the X.400 international standard for message handling, the software is in need of upgrading.

Physical Networks

The Internet

The Internet is the name given to the conglomeration of more than 2,000 national and regional data networks which interconnect worldwide. The services available include remote terminal access, network news, file transfer, electronic mail, and free access to file archives containing a remarkable variety of information.

Originally developed in the U.S. the Internet is the collaboration of the networks ARPANET, MILNET, NSFNET and other U.S. government unclassified networks. In Canada provincial networks across the country interconnect via a network called CA*net which in turn connects to the NSFNET in three locations.[3] The NSFNET is the U.S. National Science Foundation network. It is comprised of a country-wide backbone network of approximately twenty-five mid-level wide-are networks. The

[3] Marilyn Martin, "Networks to Which UBC Belongs", *Campus Computing* (UBC), 6,1 (March, 1991): 30-31.

backbone is managed by Merit, Inc., a consortium of eight Michigan universities in partnership with the State of Michigan, IBM, and MCI.

The only charges associated with connecting to the Internet are those which an institution may have to pay to connect to a regional network. In B.C. the regional network which connects to the Internet is BCnet. Its fee structure is based entirely on the one time set-up cost plus the on-going cost of leasing the necessary data lines from the institution(s) connecting to the nearest point of connection to the network.

Unlike packet switched networks such as Datapac, neither the Internet nor BCnet costs are volume sensitive. Datapac users pay specific rates for every bit of data transferred from point to point. Users on BCnet pay for (or preferably share) the cost of their leased line(s) and then they have unlimited access to the network. They are restricted only by the speed of the lines they are leasing.

BCnet

BCnet is an unincorporated non-profit consortium of cooperating members managed by a board consisting of representatives from member organizations.

It provides access to the research and education communities throughout British Columbia, throughout Canada by means of CA*net, and throughout the United States and 28 other countries by means of the CA*net links to the NSFNET. All local domain name services, mail forwarding and news feeds, though, are currently provided by CDNnet and its members rather than directly by BCnet.

The first link was brought into production in the fall of 1987. All of the universities plus TRIUMF and MPR were connected by the time of the official opening on June 9, 1988. A direct connection to the NSFNET was established in July 1989, with its cost shared with CDNnet. CA*net links connecting the Harbour Centre campus of Simon Fraser University to Toronto, Edmonton and Seattle were operational by September, 1990. The direct link to the NSFNET was decommissioned after CA*net provided the same connectivity.

In contrast to Datapac, BCnet follows the tradition of the Internet in using flat rate or "volume insensitive" charging system. BCnet provides connections at all link speeds from 2400 bits per second through 2 megabits per second. Sample dues per month are $40 for 2400 bps, $161 for 9600 bps, and $938 for 56 kbps. There are no additional usage-based charges.[4]

[4] Mike Patterson, personal communication, (June 1991).

Datapac

Datapac is the packet-switched network available through Telecom Canada and its member companies (including BCTel). Its users access databases and service bureaus that provide a broad base of commercially oriented information and services most of which have their own additional fee structures. The network uses packet-switching technology. Users are charged for the amount of data they send or receive and sometimes for the time spent connected.

B.C. colleges and institutes use services provided through Datapac and Telecom Canada in a number of ways. Most of the colleges using DEC/VAX microcomputers are operating network interfacing software called DECNET. This software allows the VAX machines to communicate with other institutions also connected to Datapac.

The colleges and institutes have been using Telecom Canada's ENVOY 100 service (described below) for almost 10 years. This commercial electronic mail service allows subscribers across the country to send and receive requests for inter-library loans, new publications, new media, policy information, as well as general communications.

The EAN (X.400) distributed message handling system also uses Datapac to send and receive messages from other computers connected to the network. Using store and forward technology mail messages can be held at one computer while waiting for a connection to another computer en route to their final destination.

Network Services[5]

Envoy 100

Envoy 100 is a Canadian commercial mail system that provides dial-up access via Datapac. It provides services such as gateways to Canada Post Corporation where messages up to four pages long can be sent and delivered by Canada Post. EnvoyCourier delivers up to thirty pages within three hours. There is currently a gateway operating at UBC between CDNnet and Envoy 100. Envoy also provides interconnection services to SprintMail, a U.S. commercial e-mail service.

CDNnet

CDNnet is a Canadian network providing OSI services to organizations engaged in education, research or advanced development. It provides electronic mail based on the X.400 mail protocols. CDNnet also provides an X.400 interconnection service to the Canadian commercial network, Envoy 100, as well as interconnects via an e-mail gateway, to the Internet.

[5] Martin, *Campus Computing*, 30-31.

Members include universities, colleges, corporations, government agencies, and non-profit organizations. There are currently approximately 80 members across Canada.

NetNorth

NetNorth is the Canadian segment of the BITNET/EARN/NetNorth network. It is an academic and research network for consortium members. In the past this network interconnected IBM mainframe machines over a series of leased data lines for file transfer and the transmission of e-mail. Because of high communications costs NetNorth has removed almost all of its leased lines and is carrying its traffic over regional networks (BCnet) and CA*net, encapsulated in TCP/IP. CA*net now provides almost all of the services offered by NetNorth.

Other Initiatives

Included below is a sampling of some of the B.C. initiatives currently underway in the area of educational electronic communications. The following descriptions are directly extracted from the sources cited.

Electronic Library Network

"The mission of the B.C. Electronic Library Network is to provide equal, timely, and economical access to information resources beyond institutional library collections and existing services, for all post-secondary participants. This shall be accomplished by providing access to remote machine-readable library catalogues and information resources, and thorough coordinated implementation of new networking information retrieval technologies, electronic information databases, and delivery mechanisms. It will be achieved through co-operation with the provinces public libraries as well as with the National Library of Canada and others."[6]

"In the Spring of 1989 the Open Learning Agency (OLA) was asked by the Ministry of Advanced Education and Job Training to coordinate an investigation of the Electronic Library Network for the provincial post-secondary system. An Advisory Committee identified two primary issues: access to bibliographic records for shared cataloguing and/or inter-library loan and document delivery (access to the various types of materials represented by those records). Two surveys of post-secondary libraries were conducted to determine the extent and type of resource sharing activity at present. Following the surveys consultants were hired to analyze the survey results, consult with the post-secondary and other library managers, and develop a list of priorized projects to be

[6] Open Learning Agency, [ELN Information Release], (Richmond, 1991)

considered for the development of the defined elements of the Electronic Library Network." [7]

"The ELN is conceived as a mosaic of services based on machine-readable information and electronic networks to support sharing among the post-secondary and other libraries. The significance of any resource in the network is determined by the types of users, their location, the nature of their information requirements and the equipment available to them. This mosaic suggest an unstructured network of services and information sources which can be configured to meet the needs of the user - either researchers, students or library staff."[8]

Southern Interior Telecommunications Project [9]

The Southern Interior Telecommunications Project (SITP) is an initiative of the Education Technology Centre of B.C., a research and leadership centre whose purpose is to promote the effective use of information technology in B.C. schools (K-12). It is a pilot project involving the Ministry of Education, SFU, B.C. Tel, DEC, and B.C. Systems Corporation to provide advanced telecommunications access to 11 southern interior school districts.

The purpose of this research project is to explore the use of information services and computer mediated communications to support students and educators. It is hoped that experience gained from this study will be used in the design of a province-wide information network for schools.

Planning for the project began in the fall of 1989, with the first phase of the project implemented during the 1990/91 school year. The second phase is to be implemented over the 1991/92 year.

The project presently involves over 150 teachers and 1500 students in over 65 schools in eleven school districts in the southern interior region of the province. The project is managed by ETC. A Steering Committee, representing the eleven school districts, Simon Fraser University and the Ministry of Education, provides strategic direction and advice.

UNBC Network

"As part of its role to provide collaborative assistance to the University of Northern British Columbia, The Open Learning Agency has undertaken to coordinate a project that will result in the development of a unified networking strategy between UNBC, OLA and the three northern

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[7] Beaumont and Associates, Ltd., *Open Learning Agency Electronic Library Network Project: Final Report*, (November 1989.) p. iv.

[8] *Ibid.*, iv.

[9] Educational Technology Centre of British Columbia, *Annual Report 1990-91*, (Victoria, 1991) , p. 6-10

community colleges; College of New Caledonia, Northern Lights and Northwest Community College.

The objective of the project is to design a network architecture that will enable the optimum use of voice, data and digital video telecommunications between the participating institutions as administrative and educational applications requiring these networks are identified and implemented. The project will examine both current and potential applications in the areas of shared administration systems, network support for courseware development and delivery, enhanced voice services and shared databases."[10]

Other telecommunications projects underway:

- OLA/Vancouver School Board ISDN Trials
- CUEBC Computer Conferencing Node
- Schoolboard-based distributed computer conferencing project
- Other electronic communications projects based at individual institutions

[10] Open Learning Agency, *Project Overview, The University of Northern British Columbia Unified Telecommunications Networking Strategy*, (Richmond, 1991), p. 1.

Appendix A - Terms of Reference

ELECTRONIC COMMUNICATIONS SYSTEMS

Project Coordinator: Jim Bizzocchi (in conjunction with Randy Bruce and with support from Lucille Pacey)

The communications group will research electronic communication systems with a view to developing strategies to assess, improve and implement computer based communications systems and other telecommunications systems

Specific computer based communications applications to be examined will include (but not be confined to) the following:

- electronic messaging
- bulletin boards
- computer conferencing
- shared databases

Specific non-computer based communications applications to be examined will include (but not be confined to) the following:

- audio conferencing
- satellite video reception
- other video conferencing
- "audio graphics" and other hybrid technologies

TASKS:

The electronic communications group will bring to SCOET the following:

- an understanding of which of these technologies are being used in the college and institute system in B.C.
- an understanding of which of these technologies are being used in other educational systems in B.C.
- recommendations on the upgrading of existing educational communications systems in B.C.
- recommendations on the integration of existing educational, government, and private sector communications systems and networks in B.C.
- information and recommendations on new technologies which could (and should) be brought into the college and institute system in B.C.

In carrying out these tasks the Communications group will liaise with other working groups within SCOET (particularly with respect to the gathering of shared information on the college system). The Communications group will gather advice and expertise from individuals within the college system and in related sectors as appropriate.

Jim Bizzocchi

Appendix B - Chart of Institution Responses

Electronic Communications Systems Database

B.C. POST SECONDARY INSTITUTIONS

Institution	Main Platform(s)	Links between Campuses	LANs	Electronic Mail	Conferencing	External Network Connections (as of December 1, 1991)
BCIT	VM, Unix, VMS	YES	YES	VM/Bitnet, SMTP, VMS (internal & external)	Bulletin (VM)	NetNorth, X.25/Datapac
Camosun	VMS	YES	YES	SMTP, VMS, X.400 (EAN)	VAX News v. 5.9c, CoSy, Confer	BCnet, X.25/Datapac
Capilano	HP3000, Unix	NO	YES	HP, NOVELL NET MAIL	none	BCnet (planned)
Cariboo	VMS, Unix	YES	YES	VMS, UNIX (internal)	Confer	X.25/Datapac
CNC	VMS, Unix[1]	NO	YES	X.400 (EAN), VMS (internal)	OPUS (BBS)	X.25/Datapac
Douglas	VMS (@ Kwantlen), AOS/VS (Data General), HP922, Unix (AT&T on a DG Aviion)	YES	YES	X.400 (EAN & CEO Office), VMS (internal)	none	X.25/Datapac, BCnet (planned)
EKCC	VMS	NO	YES	X.400 (EAN), VMS (internal)	CoSy (removed)	X.25/Datapac
ECCAD	VMS	NO	YES	VMS (minimal internal)	none	none
FVC	VMS	YES	YES	X.400 (EAN), VMS (internal)	ANU News	X.25/Datapac
Justice	VMS	NO	YES	VMS (internal)	CEO[2]	none
Kwantlen	Unix, VMS	YES	YES	X.400 (EAN), VMS, SMTP (internal)	none	X.25/Datapac, BCnet (planned)
Malaspina	VMS	YES	YES	X.400 (EAN), VMS (internal & external via X.400)	VAX Notes (?)	BCnet, X.25/Datapac
NIC	VMS, Unix	YES	YES	X.400 (EAN), VMS & SMTP	VMS CoSy	X.25/Datapac
NLC	VMS	YES	YES	VMS (internal)	none	none
NWCC	VMS	YES	YES	X.400 (EAN)	VMS CoSy	X.25/Datapac
OKC	VMS, Unix	YES	YES	X.400 (EAN), VMS & SMTP (all internal & external via X.400)	ANU News	X.25/Datapac BCnet (planned)
OLA	VMS, Mac/OS	YES	YES	VMS, X.400 (EAN), SMTP	DTN	X.25/Datapac
PMTI	DOS	NO	NO	none	none	none
Selkirk	VMS	YES	YES	X.400 (EAN) & VMS (internal & external)	VMS CoSy	X.25/Datapac
VCC	PRIMOS	YES	YES	PRIME (internal)	none	BCnet (planned)
Adv. Edu.	VMS	YES	YES	VMS, All-In-One, PROFS	All-In-One	DNET, PROVNET, BCnet
UVic	Unix, VMS, VM/SP	YES	YES	SMTP, X.400, PROFS	ReadNews	BCnet, X.25/Datapac
UBC	Unix, MTS, VMS?	YES	YES	SMTP, X.400, PROFS	★*Forum*, ReadNews	BCnet, X.25/Datapac, (NetNorth via BCnet)

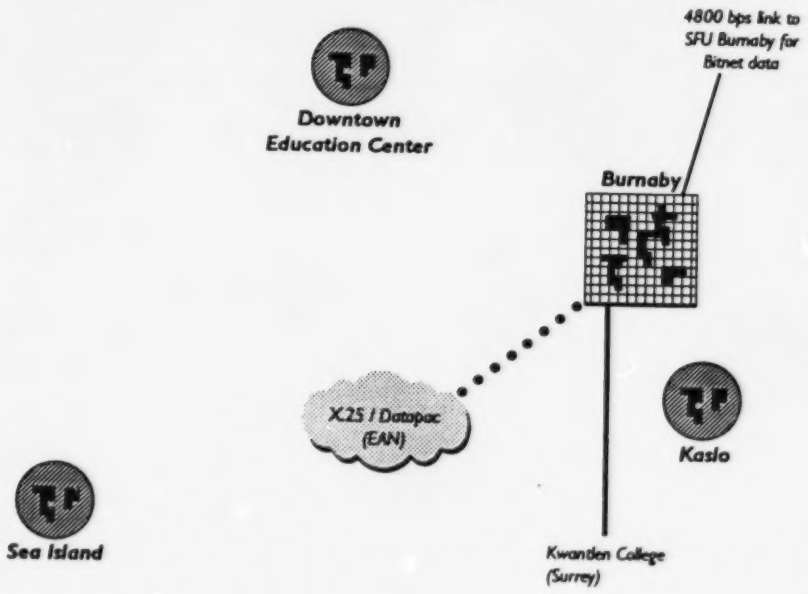
[1] AT&T version (dated).

[2] Solicitor General internal mail system

Appendix C - Institution Network Diagrams

This section contains graphical representations of the **dedicated** lines (not dial-up) which inter-connect each of the post-secondary institutions in the province. The three universities and a representation of the BCnet hub are included for reference only and may not be entirely accurate.

British Columbia Institute of Technology



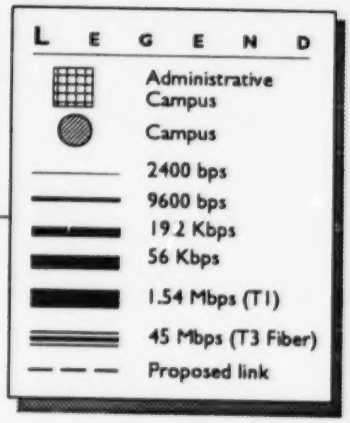
Primary Platform:
VM, Sun/UNIX, VMS

External Network Connections:
NetNorth

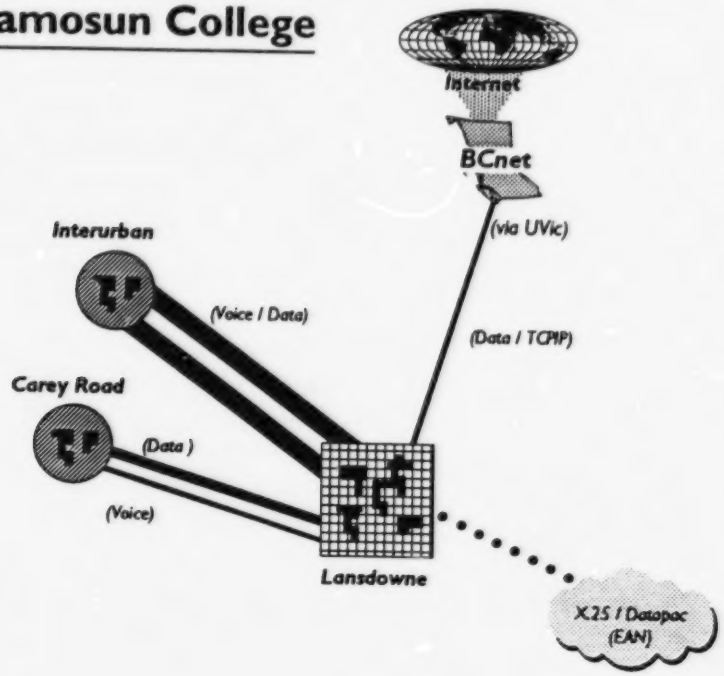
Electronic Mail:
VM/Bitnet, SMTP, VMS

Conferencing:
Bulletin (VM)

Future Plans:
May be connecting to BCnet via Douglas through Kwantlen.



Camosun College



Primary Platform:
VMS

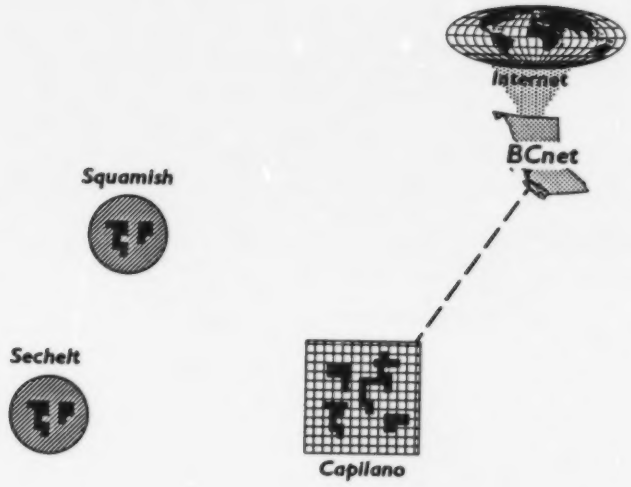
External Network Connections:
X.25/Datapac, BCnet

Electronic Mail:
SMTP, VMS, X.400 (EAN)

Conferencing:
VMS News 5.9C, VMS CoSy 3.10, Confer 1.0

Future Plans:
10 Mbps microwave link replacing both T1 links to Interurban from Lansdowne. (Spring '92)

Capilano College



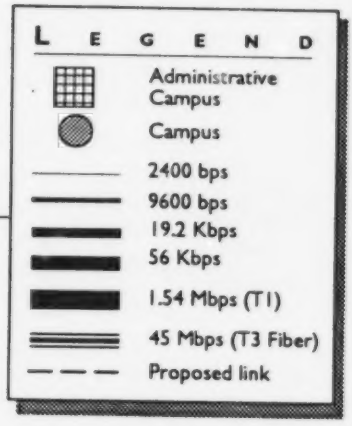
Primary Platform:
HP3000, Sun/UNIX

External Network Connections:
None

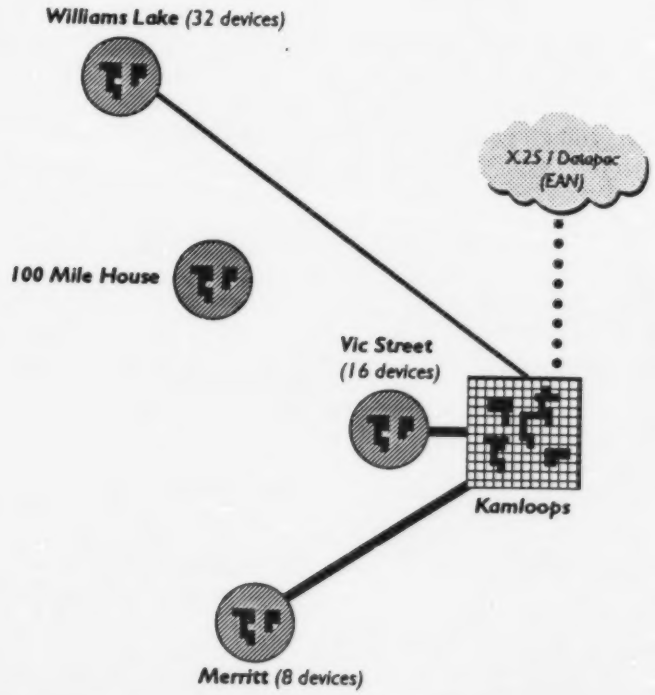
Electronic Mail:
HP mail, Novell Netmail

Conferencing:
Dial-up to SFU & UBC

Future Plans:
Connecting to BCnet via 9600 bps link to SFU Harbour Centre in the fall of 1991



Cariboo College



Primary Platform:
VMS, Sun/UNIX

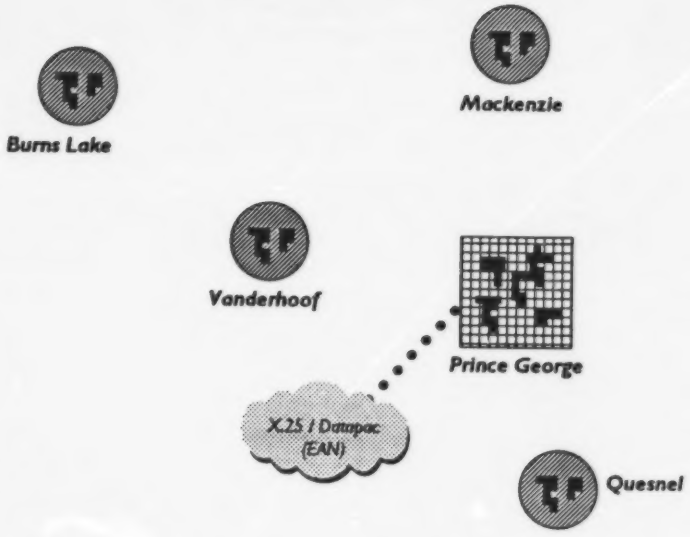
External Network Connections:
X.25/Datapac

Electronic Mail:
VMS, UNIX (internal)

Conferencing:
Confer

Future Plans:

College of New Caledonia



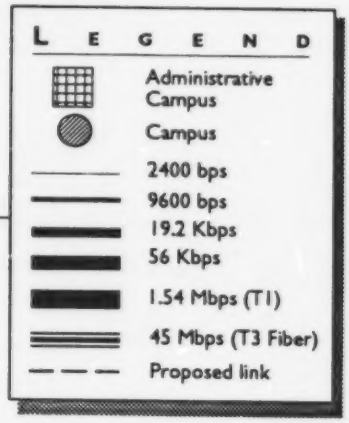
Primary Platform:
VMS, Unix (AT&T - dated version)

External Network Connections:
X.400/Datapac

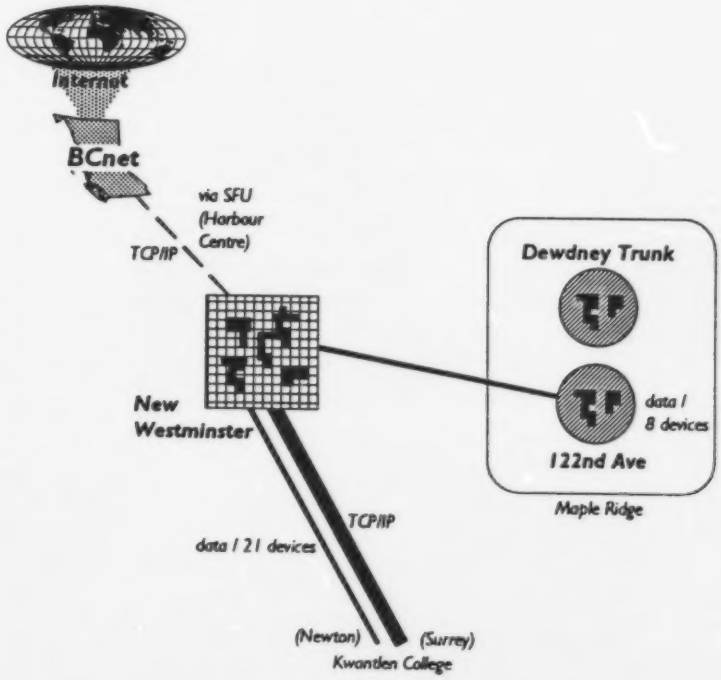
Electronic Mail:
X.400 (EAN), VMS (internal)

Conferencing:
OPUS (BBS - dial-up)

Future Plans:
Connect satellite campuses to Prince George



Douglas College



Primary Platform:
VMS, AOS/VS (Data General), HP922 Unix (AT&T : DG Aviion)

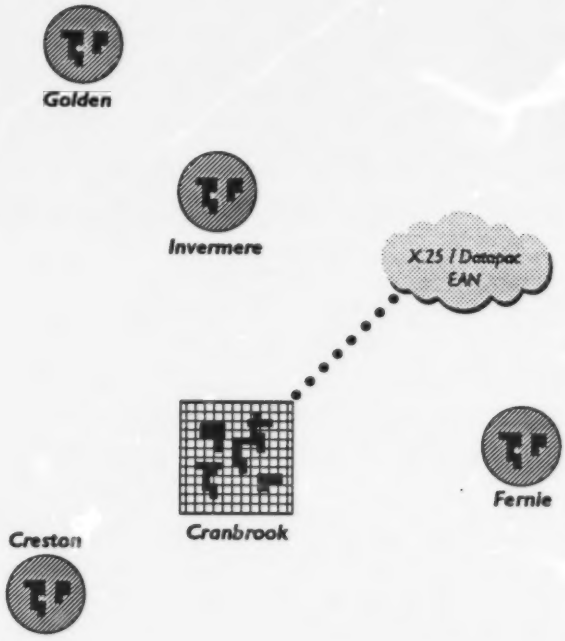
External Network Connections:
BCnet

Electronic Mail:
X.400 (EAN), VMS (external)

Conferencing:
none

Future Plans:
Connect to Coquitlam site
Conferencing software to be chosen

East Kootenay Community College



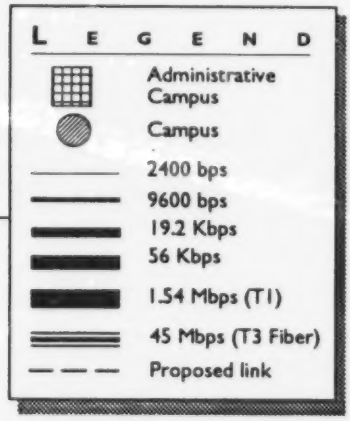
Primary Platform:
VMS

External Network Connections:
X.25 / Datapac

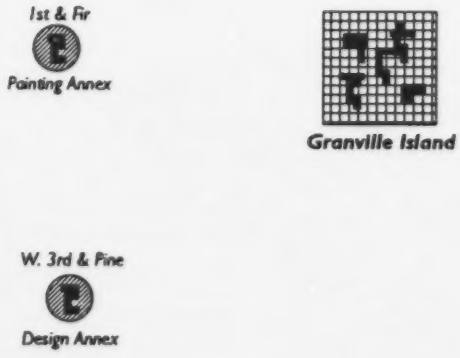
Electronic Mail:
X.400 (EAN), VMS (internal)

Conferencing:
none

Future Plans:



Emily Carr College of Art & Design



Primary Platform:
VMS

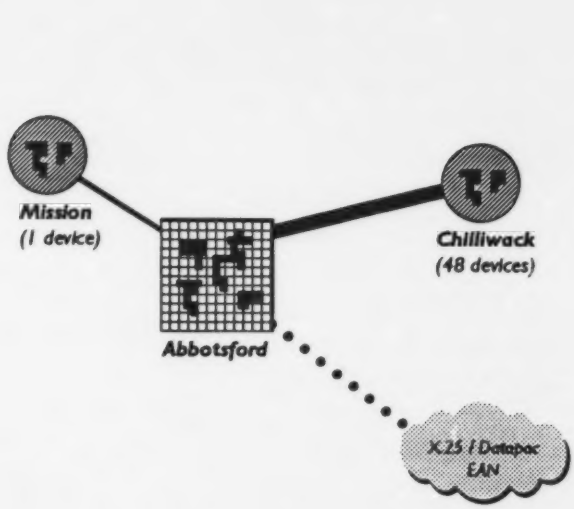
External Network Connections:
none

Electronic Mail:
VMS (internal)

Conferencing:
none

Future Plans:

Fraser Valley College



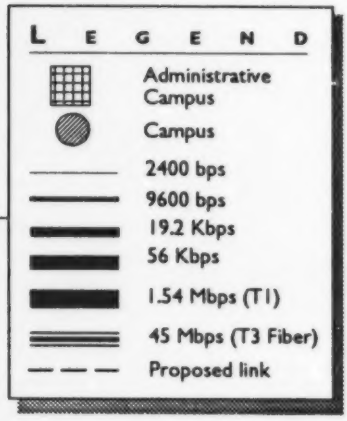
Primary Platform:
VMS

External Network Connections:
X.25 / Datapac

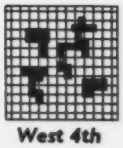
Electronic Mail:
X.400 (EAN), VMS (internal)

Conferencing:
ANU News

Future Plans:



Justice Institute



Primary Platform:
VMS

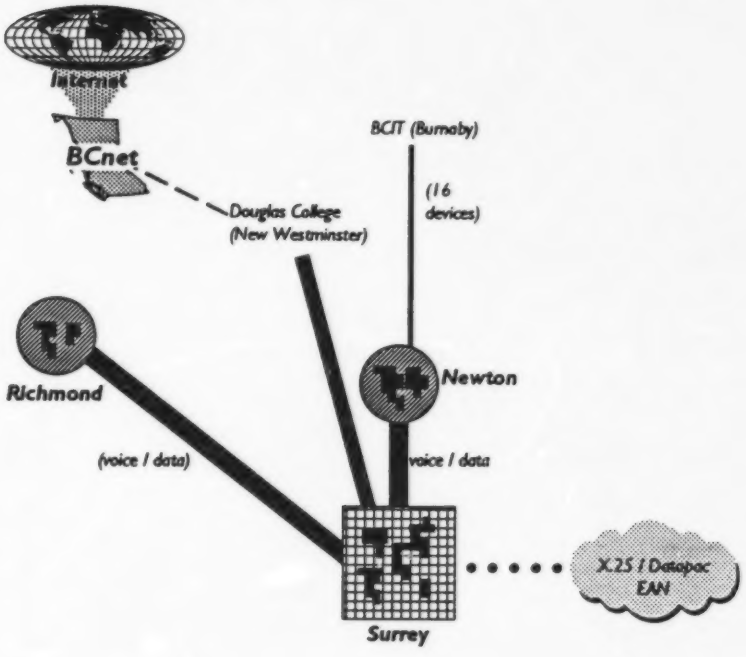
External Network Connections:
none
Dial-ub access to many database services

Electronic Mail:
VMS (internal)

Conferencing:
CEO (Solicitor General mail system)

Future Plans:

Kwantlen College



Primary Platform:
Sun/UNIX, VMS

External Network Connections:
X.25 / Datapac, BCnet (Dec '91)

Electronic Mail:
X.400 (EAN), VMS & SMTP (internal)

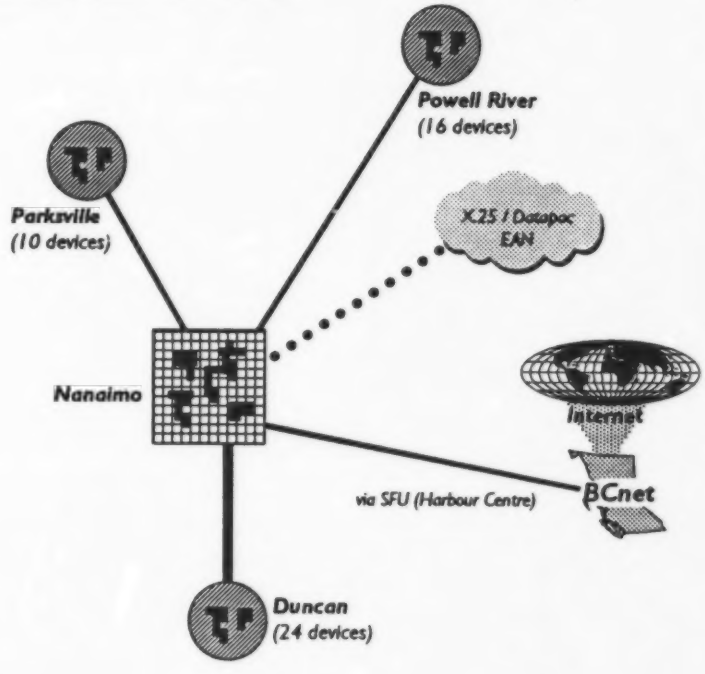
Conferencing:
none

Future Plans:
Connecting to BCnet through Douglas College
Move Douglas connection to Surrey

LEGEND

- Administrative Campus
- Campus
- 2400 bps
- 9600 bps
- 19.2 Kbps
- 56 Kbps
- 1.54 Mbps (T1)
- 45 Mbps (T3 Fiber)
- Proposed link

Malaspina College



Primary Platform:
VMS

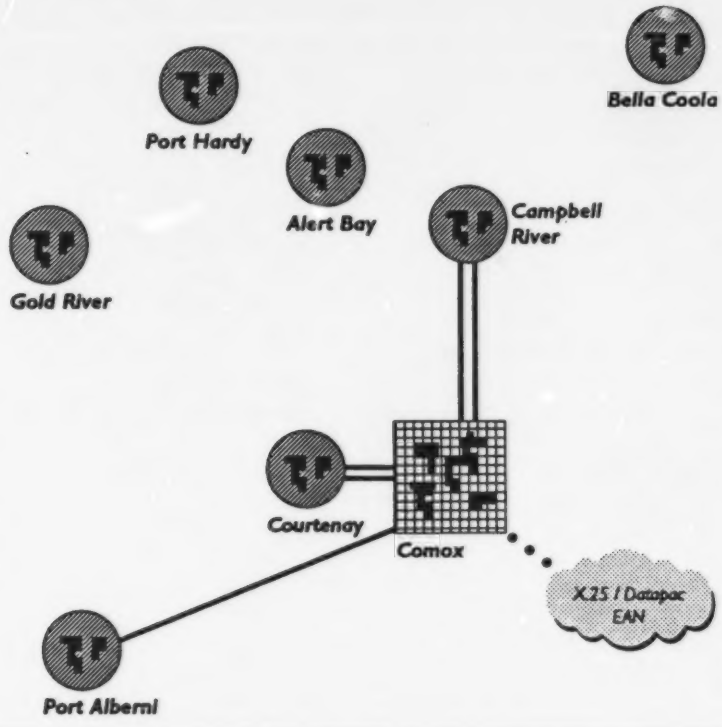
External Network Connections:
BCnet, X.25 / Datapac

Electronic Mail:
X.400 (EAN), VMS (internal & external via X.400 conversion)

Conferencing:
VAX Notes

Future Plans:

North Island College



Primary Platform:
VMS, Sun/UNIX

External Network Connections:
X.25 / Datapac

Electronic Mail:
X.400 (EAN), VMS & SMTP (internal & external)

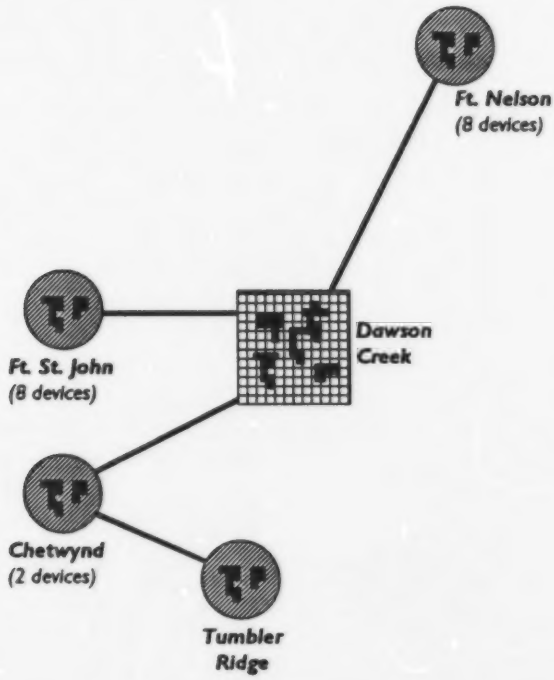
Conferencing:
VMS CoSy 3.10

Future Plans:
Major campuses (Courtenay, Comox, Campbell River, Port Alberni & Port Hardy) will be linked by 19.2 Kbps lines by March 1992. Other centres by local 2400 bps dial-up lines.

LEGEND

- Administrative Campus
- Campus
- 2400 bps
- 9600 bps
- 19.2 Kbps
- 56 Kbps
- 1.54 Mbps (T1)
- 45 Mbps (T3 Fiber)
- Proposed link

Northern Lights College



Primary Platform:
VMS

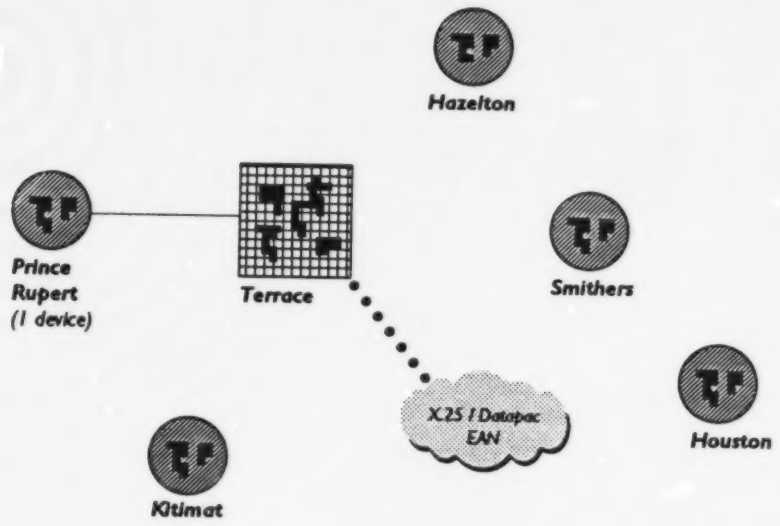
External Network Connections:
none

Electronic Mail:
VMS (internal)

Conferencing:
none

Future Plans:

Northwest Community College



Primary Platform:
VMS

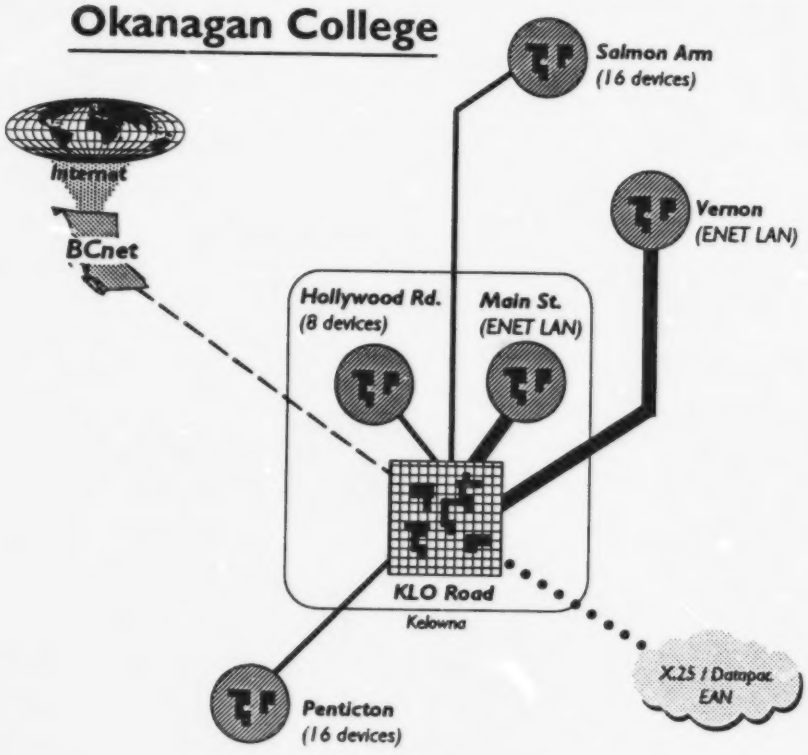
External Network Connections:
X.25 / Datapac

Electronic Mail:
X.400 (EAN), VMS (internal)

Conferencing:
None

Future Plans:
Participation in the UNBC network

Okanagan College



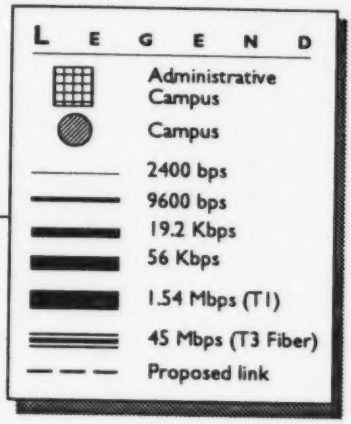
Primary Platform:
VMS, Sun/UNIX

External Network Connections:
X.25 / Datapac

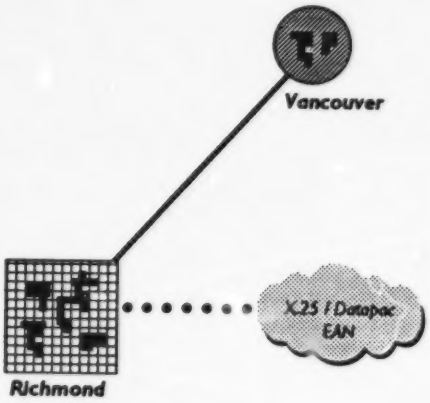
Electronic Mail:
X.400 (EAN), VMS and SMTP (all internal and external via X.400)

Conferencing:
ANU News

Future Plans:
Hopes to connect to BCnet via SITP link to SFU in Fall of '91.



Open Learning Agency



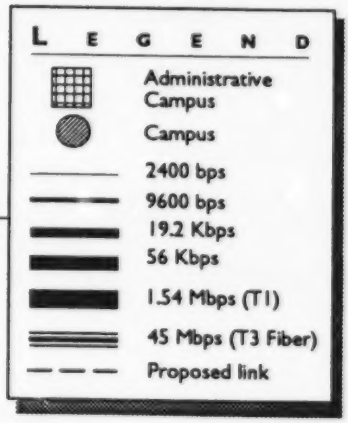
Primary Platform:
VMS, MacOS

External Network Connections:
X.25 / Datapac

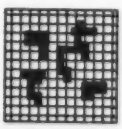
Electronic Mail:
VMS, X.400 (EAN), SMTP

Conferencing:
DTN (database)

Future Plans:
CCN, ELN, ISDN and Northern College Consortium are all OLA telecommunications projects with province-wide networking implications.



Pacific Marine Training Institute



Primary Platform:
DOS

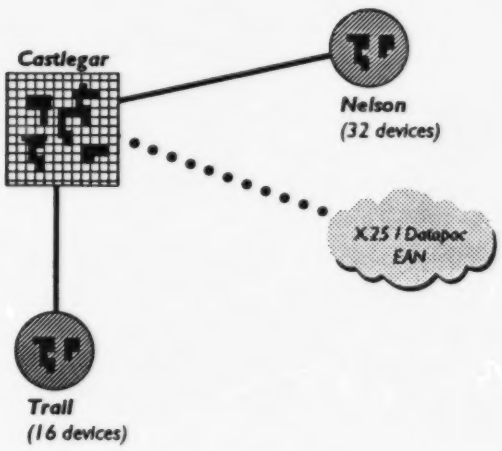
External Network Connections:
none

Electronic Mail:
none

Conferencing:
none

Future Plans:

Selkirk College



Primary Platform:
VMS

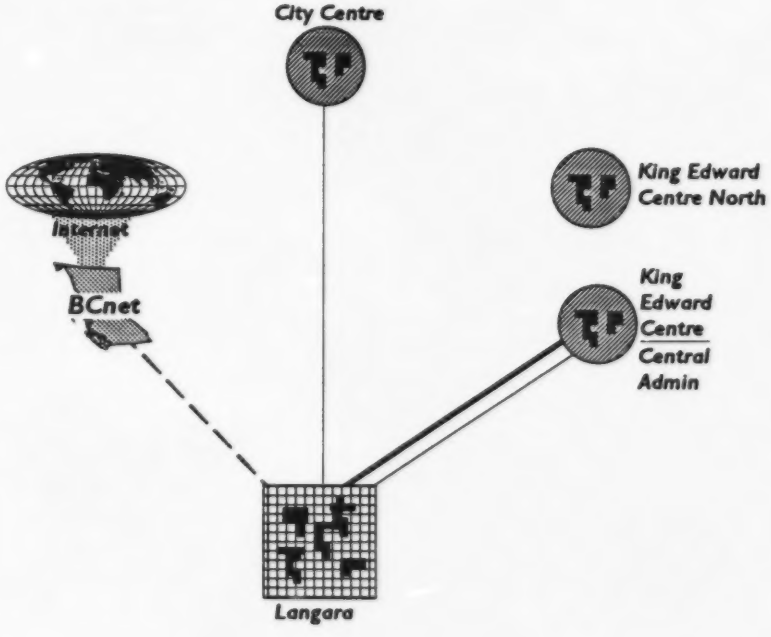
External Network Connections:
X.25 / Datapac

Electronic Mail:
X.400 (EAN), VMS (internal & external)

Conferencing:
VMS CoSy 3.10

Future Plans:

Vancouver Community College



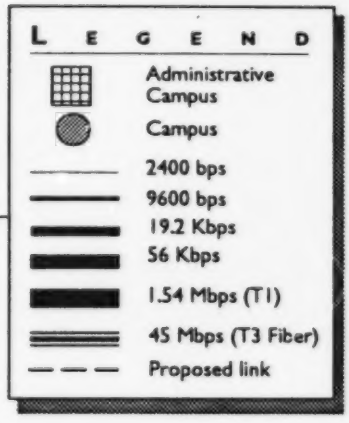
Primary Platform:
PRIMOS

External Network Connections:
none

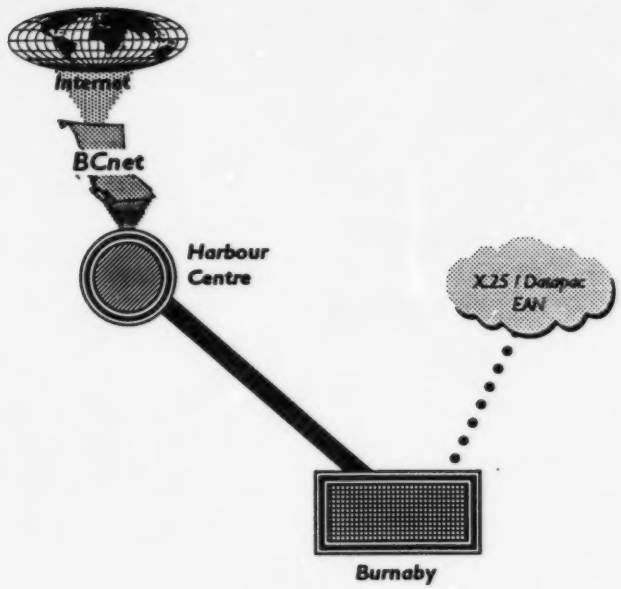
Electronic Mail:
PRIME (internal)

Conferencing:
none

Future Plans:



Simon Fraser University



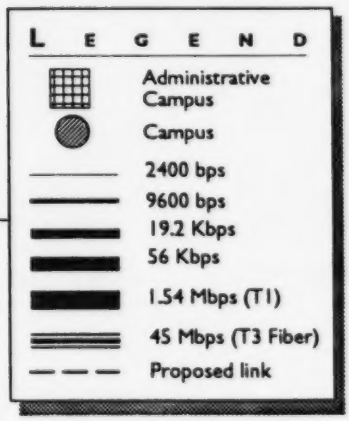
Primary Platform:
Unix

External Network Connections:
See diagram..

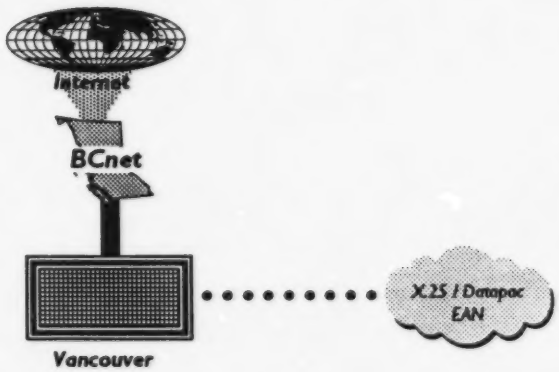
Electronic Mail:
SMTP, X.400 (EAN)

Conferencing:
ReadNews

Future Plans:



University of British Columbia



Primary Platform:
Unix, MTS, VMS

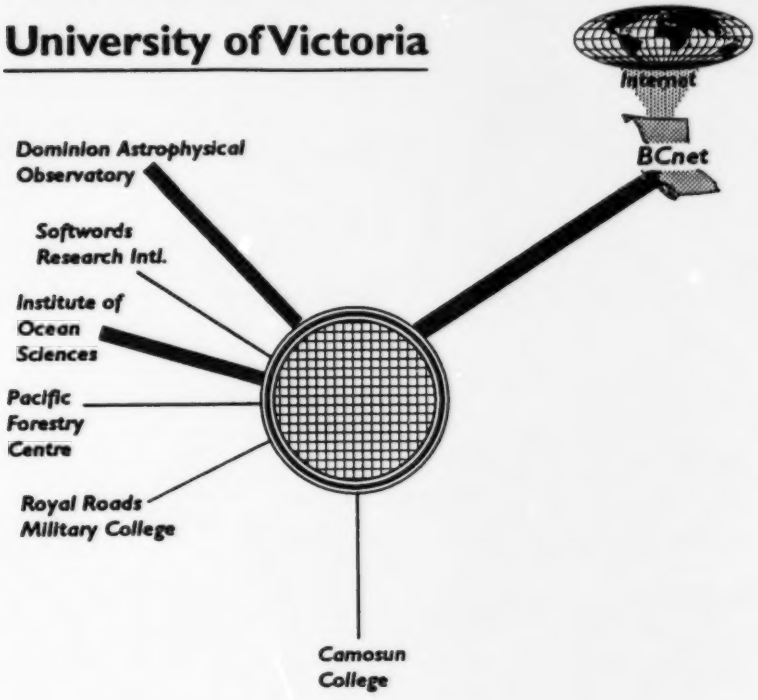
External Network Connections:
BCnet, NetNorth traffic travels over BCnet, X.25/Datapac

Electronic Mail:
SMTP, X.400 (EAN)

Conferencing:
ReadNews, ★Forum

Future Plans:

University of Victoria



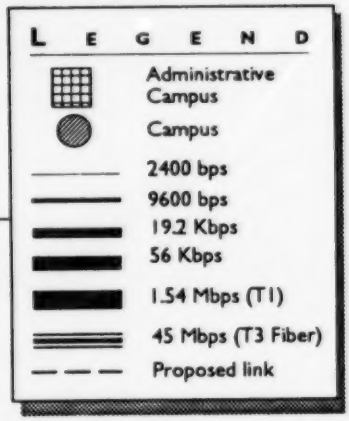
Primary Platform:
Unix, VMS, VM/SP

External Network Connections:
BCnet, X.25/Datapac

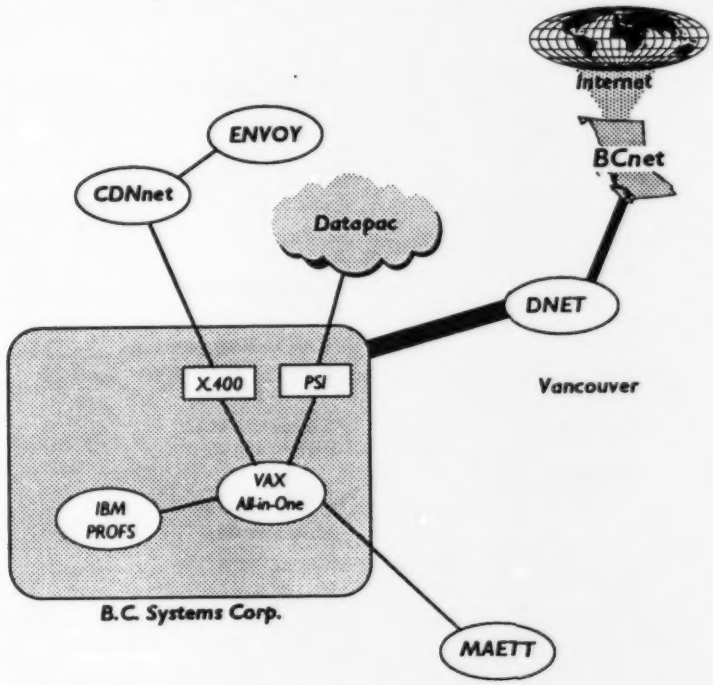
Electronic Mail:
SMTP, PROFS

Conferencing:
ReadNews

Future Plans:



Ministry of Advanced Education



Primary Platform:
VMS, VM

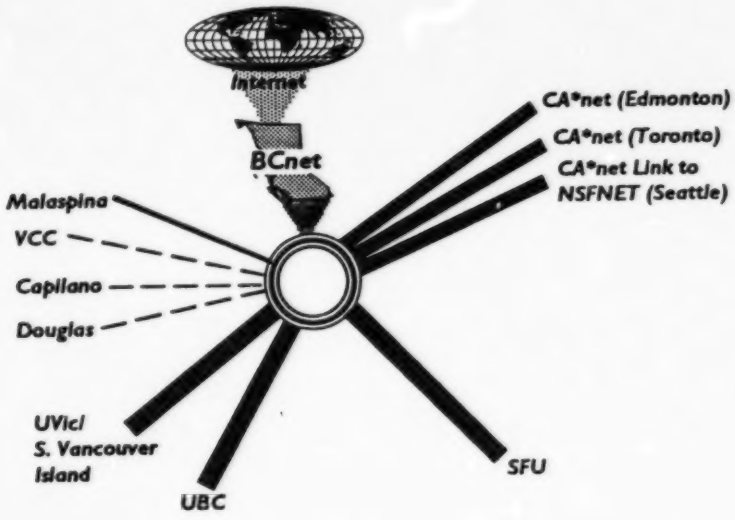
External Network Connections:
DNET, X.25, BCnet access

Electronic Mail:
PROFS, VAX Mail, All-in-One

Conferencing:
All-in-One

Future Plans:

BCnet Hub



◆ This diagram shows some of the connections that BCnet maintains at the Hrbour Centre in Vancouver.

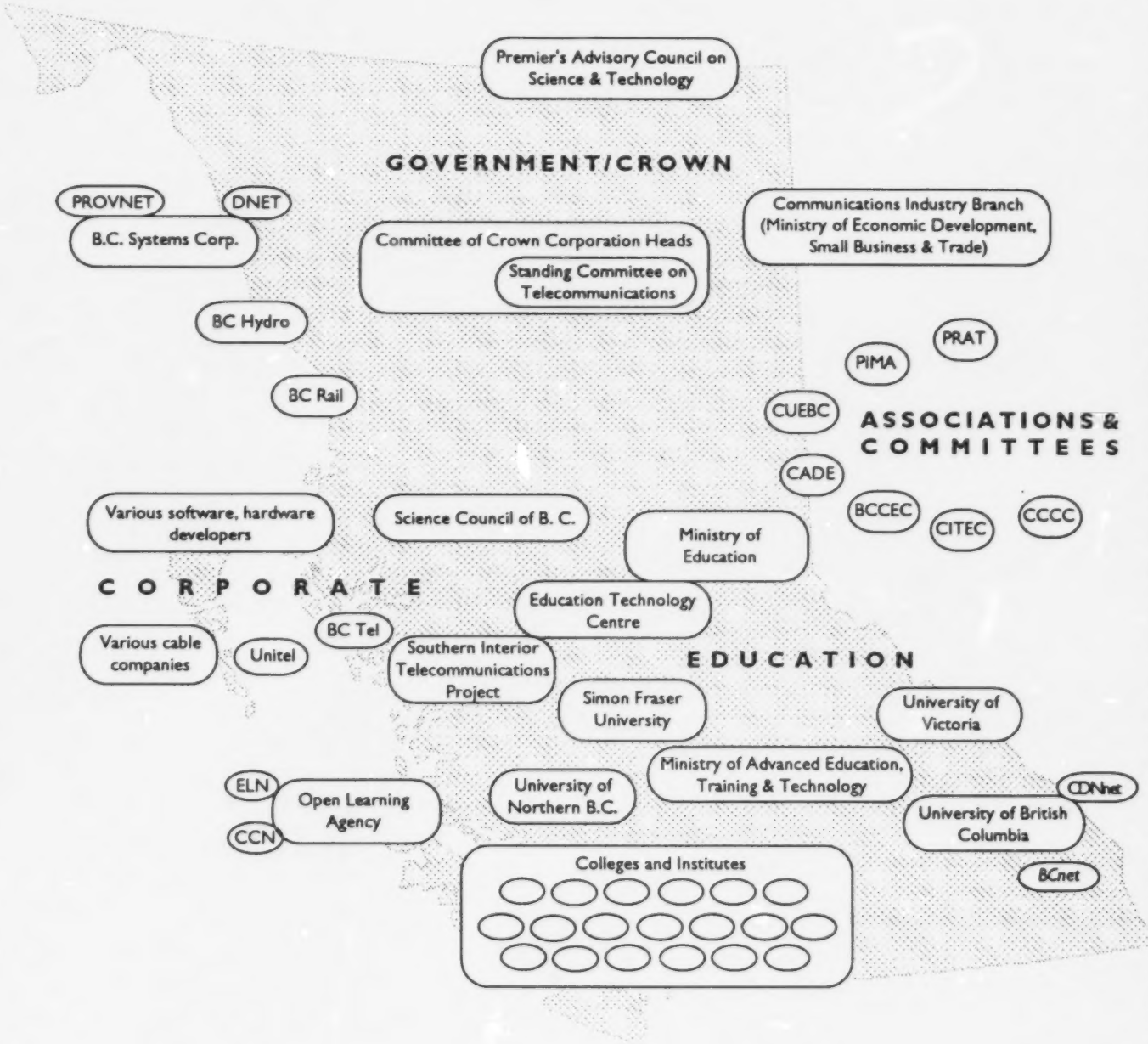
Appendix D - Institution Responses

Available upon request. Contact the SCOET office for more information.

Appendix E - Telecommunications Infrastructure

Telecommunications Infrastructure

BRITISH COLUMBIA



❖ This chart represents some of the organizations that play (or could play) a significant role in educational telecommunications in B.C.

Roles and Functions of Key Players

Function/Role: Sector:	Decision Makers/Policy Advice	Users	Services	Bandwidth Vendors
Government / Crown	PACST CCCH Science Council	Ministries Public institutions (inc. hospitals, libraries, & municipalities)	BCSC	B.C. Hydro B.C. Rail
Education	SCOET CCCC	K-12 system Colleges Technical Institutions Universities	Open Learning Agency BCnet CDNnet	n/a
Corporate	n/a	n/a	Telecom Canada	B.C. Tel Unitel

Telecommunications Players in British Columbia

Government and Crown

Premier's Advisory Council on Science and Technology	(PACST) Members from business, industry and education sectors advise the Premier on developments and implications.
Committee of Crown Corporation Heads	(CCCH) Working group of Crown Corporations; has a subcommittee for telecommunications.
Ministry of Economic Development, Small Business & Trade	(MEDSBT) Communications Industry branch handles the telecommunications policy and regulatory matters for the province.
B.C. Systems Corporation	(BCSC) Provides communications systems and support for the provincial government. Administers PROVNET (government telephone service), DNET and the SNA shared network (government data service).
B.C. Rail	Operates a telecommunication system with voice and data links along its right of way. Offers these services as a common carrier to other users.
B.C. Hydro	Operates microwave-based voice and data communications system across the province.
Science Council of B.C.	Identifies and promotes opportunities for the economic development of B.C. by drawing on the science and technology communities for creative applications of innovative science and technology.

Educational

Universities	Each of the universities have played a significant role in the development of the educational telecommunications infrastructure in B.C.
BCnet	Membership provides access to the provinces' high speed research and development data network as well as access to CA*net and NSFNET (Internet).
CDNnet	Provides OSI services to organizations engaged in education, research or advanced development. Currently has approximately 80 members across Canada.
Open Learning Agency	Provides leadership in developing and maintaining a province wide open learning system in order to make lifelong training and educational opportunities available to all the people of B.C. Part of their mandate is to develop and manage electronic networks to serve the educational needs of the province.
Education Technology Centre of B.C.	(ETC) A research and leadership centre whose purpose is to promote the effective use of information technology in B.C. schools (K-12).
Southern Interior Telecommunications Project	(SITP) A pilot project of the ETC involving the Ministry of Education, SFU, B.C. Tel, DEC, and BCSC to provide advanced telecommunications access to 11 B.C. southern interior school districts.

Corporate

B.C. Tel	B.C. most popular carrier and provider of universal telephone service (excepting parts of northern B.C.), as well as significant public and private data services such as Datapac and Dataroute. Is a member of the Canadian association of telephone companies, Telecom Canada.
Unitel	Telecom Canada's main competition for private line voice, facsimile and data transmission. Owned jointly by Rogers Cablevision and Canadian Pacific Railway.

Associations and Committees

BCCEC	British Columbia Computers in Education Committee. An articulation committee for computer science, business computing, computing information systems (CIS), and other related programs. Participants include one or more representatives from all of the colleges, institutes and universities including private organizations. MAETT and various school boards also participate in the semi-annual meetings.
CADE	Canadian Association for Distance Education. The national professional organization for distance educators. Membership includes education, private sector and government. Many B.C. members.

CCCC	Computing and Communications Coordinating Committee. Provides a vehicle for communicating and coordinating information technology initiatives within the B.C. post secondary system. It is comprised of managers responsible for computing, communications and information systems services at the colleges, institutes and universities.
CITEC	Colleges and Institutes Technology in Education Committee. Primarily a group of college and institute educators and specialists active in instructional computing applications. Includes people from outside the "traditional" computing disciplines.
CUEBC	Computer Using Educators of British Columbia. A group of K-12 educators active in educational computing instruction and applications.
PIMA	Pacific Instructional Media Association. A B.C. based association of instructional media professionals (including the use of computers in educational delivery). Has members from private sector and all the educational levels.
PRAT	Pacific Regional Association for Telematics. An association of organizations and individuals interested in computer communications and its implications for B.C.

Appendix F - Glossary of Terms

ARCnet	Attached Resource Computer Network. Basic LAN technology.
asynchronous	A style of sending data across a communications line where each character can be sent at any time. The standard style for sending data between two modems.
audio conferencing	Conferencing involving more than two parties over voice connections.
audio graphics	Audio graphics is a technology that combines audio, text and graphics/video capabilities. Most audio graphic systems are computer based and use telephone lines to connect for real time two way and multi-point communication.
B.C. Advanced Systems Institute	A private, non-profit society who's mission is the development and application of "Advanced Systems" disciplines through collaborative efforts with B.C. universities and industry for econimic benefit to the province and country.
BCCEC	British Columbia Computer Educators Committee
backbone	A high speed network that interconnects other networks.
bandwidth	The maximum amount of data which can pass along a data line at one time usually represented in bits per second (bps), kilobits per second (kbps) or megabits per second (Mbps). (syn. *capacity*)
BAS	Budgetary Accounting System. A VAX/VMS based finance package from SRB International.
BCnet	A physical data network connecting B.C. educational, research and development organizations and institutions to each other and to international data networks such as CA*net in Canada and NFSNET in the U.S.
bits	Binary digits. The smallest components of computer information. A single bit can be seen as a switch, either "on" or "off", or as having a value of either zero or one. A bit is also a measurement of memory capacity.
Bitnet	A store and forward network used for e-mail and file transfer especially between IBM mainframe machines.
bridge	A device that connects two or more similar networks and forwards packets between them.
Bucat	Brandon University Catalogue System. A library automation system providing on-line catalogues, circulation and acquisition services.
bulletin board system	(BBS) A self-contained mini-on-line service, usually free, usually consisting of a personal computer and special software and hardware which receives calls from other people's computers and provides any number of electronic services.

CDNnet	A Canadian network providing OSI services, electronic mail based on the X.400 protocol, interconnection to the Canadian commercial network Envoy 100, and an electronic mail gateway to the Internet.
CITEC	Colleges & Institutes Technology in Education Committee.
CAI/CAL	Computer Assisted Instruction/Learning - Instruction or learning where the role of computers is limited to the enhancement of either process.
CBE	Computer Based Education. Varying degrees of computer use which either focus on the instructional aspect or the learning aspect of computer applications. Computer Based Education encompasses CAI, CAL, CBI and CBL.
CBI/CBL	Computer Based Instruction/Learning - Instruction or learning where the role of computers encompass more complex functions such as understanding concepts and their application to problem solving.
CCITT	Consultative Committee for International Telephony and Telegraphy. An organization responsible for establishing telecommunications and data communications standards.
computer conferencing	A computer mediated communications tool which enables ongoing interactive dialogue. Conversations are stored and held for each participant to read and/or respond at their own leisure.
CML	Computer Managed Learning. The use of computers to manage the entire learning process.
CCCC	Computing & Communication Coordinators Committee.
CoSy	(**Co**nferencing **Sy**stem) Computer conferencing system software originally developed by the University of Guelph in 1987.
Datapac	Telecom Canada's packet-switched network.
database	Any organized collection of data, gathered and stored under some database management system.
DEC	Digital Equipment Corporation.
DECnet	Software which allows B.C. colleges with VAX computers to communicate over Datapac with other institutions with the same setup.
delivery	The presentation of material. Generally referred to in the context of media used to present instructional material, such as audio, video, or the application of a specific type of computer software.
DG	Data General. A computer hardware manufacturer.
dial-up	The act or process of connecting one computer to another using modems and existing communication lines.

distributed file system	A file system in which different pieces of different files are contained in multiple file servers in multiple locations throughout a given network.
EAN	A message handling system developed by the Distributed Systems Research Group in the Department of Computer Science at UBC in the mid 1980's for the Unix and VAX/VMS operating systems.
educational technology	Communications, media, computer or other electronic technologies as the *subject* of educational programs, or, as *applied* in the development, delivery and administration of educational programs, or as *used* by students to facilitate or enhance their education.
ELN	Electronic Library Network.
ENVOY	A Canadian Commercial Electronic Network providing various information and services.
Ethernet	A popular 10Mbps network architecture designed by Xerox that uses passive cabling to connect workstations through the use of network interface cards.
external mail	Electronic mail with a destination outside the institution in which it is originated.
file server	A computer dedicated to storing and delivering data.
file sharing	A configuration of computers whereby more than one machine has access to the same files or software.
gateway	A network device used to connect two or more dissimilar networks. Gateways perform protocol conversions (e.g. between a TCP/IP based network and a Novell network).
HP	Hewlett-Packard, a popular hardware manufacturer.
internal mail	Electronic mail with a destination inside the institution in which it is originated.
LAN	Local Area Network. A local collection of computers, printers, modems and other devices that are interconnected through one of the standard network architectures such as Ethernet, Token-Ring.
leased line	A data line which maintains a connection between two points and is paid for by its user or user organization.
Libcat	Library Cataloguing system. A library automation system.
megabit	1,000,000 bytes.
minicomputer	A computer greater in price, capacity and power than a micro-computer but less than a mainframe.
MIS	Management Information System - A computer based system of data organization and management which provides information to managers to assist them in the decision-making process.

modem	Modulator/de-modulator. A device used to translate digital information from one machine into analog form, transmit it over analog data lines and then translate it back to digital form for the recipient machine.
MTS	Michigan Terminal System. An operating system for IBM mainframes.
multi-media	The combination of more than one element of educational technology. Typically this refers to the combination of text, graphics and audio produced with various devices but monitored and/or controlled at a single control centre, such as a computer.
NetNorth	The Canadian segment of the BITNET/EARN network. Now carrying almost all of its traffic over BCnet.
Novell	A company which produces popular micro-computer networking software.
NSFNET	NSFNET is the U.S. National Science Foundation network. It is comprised of a country-wide backbone network of approximately twenty-five mid-level wide-are networks. The backbone is managed by Merit, Inc., a consortium of eight Michigan universities in partnership with the State of Michigan, IBM, and MCI.
OSI	Open Systems Interconnect. The International Standards Organization's (ISO) effort at establishing a global standard for communications and networking. OSI is based on the OSI seven layer communications model, often referred to as the OSI Reference Model (OSIRM).
packet switched network	A physical network which relies on packet switching (as opposed to circuit switching) as its means of transmitting data
PIMA	Pacific Instructional Media Association.
platform	The specific combination and configuration of hardware and software used in the delivery of a computer application. Can be as general as a description of the operating system or as specific as a listing of the devices brand names and model numbers involved.
presentation software	Software designed to facilitate the computer presentation of text and graphics. i.e. Harvard Graphics (when audio is incorporated it is usually referred to as multimedia).
proprietary software/hardware	Software or hardware designed by a manufacturer to work only with other software/hardware they manufacture.
protocol	The predefined hardware, software or methodology and related set of parameters which allow two different devices to communicate.
report generation software	Software designed to organize data and produce reports in a specified format from raw data.

router	A communications device designed to make decisions about which of several paths a packet of information will take.
SMTP	Simple Mail Transfer Protocol. One of the main protocols of the TCP/IP suite that is used for transferring electronic mail messages from one computer to another.
SRS	Student Record System. (VAX/VMS based)
standardized hardware/software	Local agreement to purchase and use the same hardware and/or software in order to avoid problems of incompatibility.
Sun Microsystems	A popular vendor of Unix based computing systems.
T1	A high-speed telecommunications line operating at 1.544 Mbps.
T3	A high-speed telecommunications line operating at 45 Mbps.
TCP/IP	Transmission Control Protocol/Internet Protocol. An important and major protocol suite, of which TCP and IP are the two key protocols, allowing large internetworks of communicating machines to be built.
Telecom Canada	An association of 10 Canadian telecommunications companies (including BCTel). It coordinates operations of the national telecommunications network, marketing products and services nationwide and coordinating the division of revenues from these services.
telecourse	Telecourses can be credit or non-credit and are usually accompanied by print materials and tutorial support.
testbanking	An abbreviated form of test item banking whereby test items are stored in a computer to be used in the design of tests, quizzes and exams. Testbanking refers specifically to the storage of tests.
Token Ring	A 4 Mbps and 16 Mbps token-passing network architecture designed by IBM.
UNIX	An operating system first developed by Bell Laboratories in the 1970's which has become the de facto standard for open computing systems.
VAX	A series of DEC computers.
video conferencing	Conferencing which incorporates the use of two-way audio and video transmission to connect participants at various locations.
VM	An operating system for the IBM mainframe.
VMS	The operating system developed by DEC for their VAX computers.
WAN	A collection of disparate, widely located and geographically isolated networks, connected by private or public communications lines, or some combination of both.

X.25	A packet switching-based wide area networking technology. X.25 networks can be private, but the majority of X.25 usage is through services provided by public carriers.
X.400, X.500	CCITT-based (and OSI adopted) standards. X.400 covers electronic mail and store-and-forward communications. X.500 covers address definition and is designed to be used by X.400-compliant systems.

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